IDAHO

FISH & GAME DEPARTMENT

Joseph C. Greenley, Director

Annual Completion Report Project F-49-R-11

Job No. II-a Salmon and Steelhead Production and Yield Studies,
Lemhi Big Springs Creek

Job No. II-b Salmon and Steelhead Yield, Escapement, and Harvest Studies, Lemhi River

March 1, 1972 to February 8, 1973

by

Ted C. Bjornn
Idaho Cooperative Fishery Unit

August, 1973

TABLE OF CONTENTS

Job No. II-a. Page

ABSTRACT 1

RECOMMENDATIONS 2

OBJECTIVES 2

TECHNIQUES USED 2

FINDINGS 3

- Fry Released into Stream 3
- Population Sampling with Electrofishing Gear 3
- Number of Downstream Migrants 6
- Rainbow-steelhead Downstream Migrants - Upper Lemhi River 13

LITERATURE CITED 20

Job No. II-b.

ABSTRACT 21

RECOMMENDATIONS 22

OBJECTIVES 22

TECHNIQUES USED 22

FINDINGS 23

- Enumeration of Adult Chinook Salmon 23
- Chinook Salmon Spawn-taking Operation 27
- Estimated Spawning Escapement 27
- Redds counted 27
- Enumeration of Adult Steelhead Trout 27
- Enumeration of Juvenile Salmon 31

LIST OF TABLES

Job No. II-a Page

Table No. 1 The number of eyed steelhead trout eggs planted in the Big Springs Creek incubation channel, emergent fry counted from the trap, survival from eyed egg to emergent fry, and the estimated number of live fry entering the creek 4

Table No. 2 The number of age-class I and older rainbow-steelhead trout collected in sample sections of Lemhi Big Springs Creek during July or August.....5

Table No. 3 The number of age-class I and older rainbow-steelhead trout and brook trout collected from sample sections of Big Springs Creek during mid-summer..... 7

Table No. 4 The number of nights the Big Springs Creek downstream migrant weir was operated, number of rainbow-steelhead trout caught, mean catch per night and estimated number of trout which migrated from Big Springs Creek during each month of 1972 8

Table No. 5 The estimated number, age-class, and year-class of rainbow-steelhead trout which left Big Springs Creek during 1972..... 9

Table No. 6 The estimated number of rainbow-steelhead trout of each year-class which left Big Springs Creek during various time periods 10

Table No. 7 Estimated number of age 0 chinook salmon juveniles migrating from Big Springs Creek during the period 1962-1972. Figures in parentheses subjective estimates not based on trapping 12

Table No. 8 The number of days Lemhi louver trap was operated, catch of juvenile rainbow-steelhead trout, and percentage age age-class composition of catch in 1972 14

Table No. 9 The estimated number of rainbow-steelhead trout of each year class which migrated from Big Springs Creek, past the Lemhi River weir site and number of smolts passing Lemhi weir site of Big Springs Creek origin. 16

Table No.10 The estimated yield of steelhead trout smolts in the upper Lemhi River drainage from steelhead trout fry released into Big Springs Creek. 18

Table No.11 The yield of rainbow-steelhead trout migrants per 100 square yards in Big Springs Creek..... 19

LIST OF TABLES (Continued)

Job No. II-b

		Page
Table No. 1	Daily counts of adult chinook salmon at the Lemhi River weir during 1972.	24
Table No. 2	Count of chinook salmon at the Lemhi weir by month and percentage of total run passing weir in August. .	25
Table No. 3	Length-age group of chinook salmon counted at the Lemhi weir in 1972.	26
Table No. 4	The daily count of adult steelhead trout at the Lemhi River weir during 1972.	28
Table No. 5	Length-frequency of adult steelhead trout captured and measured at the Lemhi River weir in 1972. . . .	30
Table No. 6	The number of days the Lemhi River lower trap was operated, chinook young-of-the-year and yearlings caught, and the estimated number of juveniles migrating downstream past the trap site in 1972. . .	32
Table No. 7	The estimated number of [illegible]	35

JOB COMPLETION REPORT RESEARCH PROJECT SEGMENT

State of Idaho

Project No. F-49-R-11

Job No. II-a

Name: SALMON AND STEELHEAD INVESTIGATIONS

Title: Salmon and Steelhead Production and Yield Studies, Lemhi Big Springs Creek

Period Covered: March 1, 1972 to February 28,1973

ABSTRACT

In 1972, as in 1971, we were able to establish a large juvenile chinook salmon population in Big Springs Creek during the summer rearing period and observe the yield of salmon and trout with sympatric populations. Prior to 1971, the stream contained essentially an allopatric population of rainbow-steelhead trout, although we had attempted (unsuccessfully) to introduce chinook each year since 1968.

We released 291,600 chinook fingerlings into the creek about June 1, 1972. From September through December, 57,000 age 0 chinook salmon left the creek.

We released 358,190 steelhead trout fry into the creek on June 21, 1972. The yield (15, 380) of age 0 rainbow-steelhead from the stream in the fall of 1972 was nearly triple the number counted in 1971.

The combined yield of 67,000 age 0 chinook salmon and rainbow-steelhead trout in the fall of 1972 was triple the largest yield ever recorded from the stream when only rainbow-steelhead trout were present. The yield from an allopatric steelhead population established from a fry release equal in number to the combined releases of chinook and steelhead will be tested in 1973.

Author: Ted C. Bjornn
Idaho Cooperative Fishery Unit
Moscow, Idaho

RECOMMENDATIONS:

Studies with sympatric populations of steelhead and chinook salmon will be completed in 1973. Only a small number (5,000) of chinook fingerlings will be released in the stream during 1973 as part of the Parr-Smolt transformation studies. Approximately 600,000 to 800,000 steelhead trout fry should be released in the stream in 1973 to assess yield from steelhead fry releases equal in number to the combined releases of chinook and steel-head in 1972.

OBJECTIVES:

To enumerate the number of fish of various species and age classes that leave Big Springs Creek.

To correlate age, length and rate of growth of juvenile steelhead in Big Springs Creek with their seaward migration.

To determine the number of steelhead smolts produced in Big Springs Creek as related to population density and interspecific competition.

To determine the yield and production of juvenile salmon and steelhead in Big Springs Creek when large numbers of fry of each species are liberated into the stream.

TECHNIQUES USED:

In 1972, steelhead trout eggs for Big Springs Creek were obtained from adult steelhead which returned to the Pahsimeroi River (formerly Snake River stock). The eggs were incubated at MacKay hatchery, and the fry were released into the stream as swim-up fry, June 21, 1972, more than a month earlier than in 1971.

Chinook salmon fingerlings of the 1971 year class were released into the Creek May 31 and June 1, 1972. The fingerlings released in the Creek during 1972 came from the Rapid River hatchery; a spring run chinook stock (also formerly Snake River fish).

Midsummer sampling of fish in Big Springs Creek with DC electrofishing gear was not conducted in the same manner as in previous years. I used the data collected by the crews sampling the fish population for production estimates during August to assess relative species and age composition. Although different areas of the creek were sampled than usual, I believe the data accurately represents the fish populations.

Operation of the Big Springs Creek and Lemhi weirs for the collection of downstream migrants was the same as in previous years.

FINDINGS:

Fry Released into Stream

On June 21, 1972, we released 358,190 swim-up steelhead trout fry into Big Springs Creek near the upper (incubation channel) section of the stream (Table 1). We released the largest number of fry on the earliest date of any year during the study.

We released 291,600 chinook fingerlings (55-65 mm mean fork length) from Rapid River hatchery stock in the upstream areas of the creek May 31 and June 1, 1972.

Population Sampling with Electrofishing Gear

Age-Class I fish again comprised a high percentage (91%) of the age-class I and older rainbow-steelhead trout collected in 1972 (Table 2).

Table 1. The number of eyed steelhead trout eggs planted in the Big Springs Creek incubation channel, emergent fry counted from the trap, survival from eyed egg to emergent fry, and the estimated number of live fry entering the creek.

Year planted	Eyed eggs planted	Fry counted from trap	Percent Survival	Live fry entering creek
1962	69,244	65,872	92.1	64,500
1963	460,134	195,679	42.5	193,300
1964	333,057	298,877	89.7	298,400
1965	336,951	152,500	45.3	151,500
1966 1/	143,990	137,284	95.3	136,900
1967 1/	549,471	217,290	39.5	213,600
1968 2/	-------	-------	----	219,000
1969 2/	-------	-------	----	322,400
1970 2/	-------	-------	----	206,000
1971 2/	-------	-------	----	136,800
1972 1/ 2/	-------	-------	----	358,190

1/ Eggs from Mid-Snake River stock of steelhead collected at Oxbow Dam or Pahsimeroi River. Steelhead eggs used in all other years from Clearwater River stock.

2/ Eggs incubated in hatchery and fry released into stream at swim-fry stage.

Table 2. The number of age-class I and older rainbow-steelhead trout collected in sample sections of Lemhi Big Springs Creek during July or August.

Year	Age-Class I				Age-class II and older			
	Length 1/ range (millimeters)	Number	Percentage of total	Confidence interval (0.95)	Length range (millimeters)	Number	Percentage of total	Confidence interval (0.95)
1962	90-209	222	56	51.3-61.1	210+	173	44	38.9-48.7
1963	90-219	617	80	77.3-82.9	220+	153	20	17.1-22.7
1964	90-219	427	83	79.3-85.9	220+	91	17	14.1-20.7
1965	90.219	741	94	97.7-95.9	220+	45	6	4.1-7.3
1966	90-219	394	88		220+	52	12	
1967	90-229	272	84		230+	53	16	
1968	100-239	1188	94		240+	78	6	
1969	100-229	812	93		230+	63	7	
1970	90-239	662	93		240+	47	9	
1971	100-239	555	91		240+	53	9	
1972	100-229	502	91		230+	48	9	

Juvenile steelhead continue to predominate in the rainbow-steelhead trout population in the stream.

Brook trout comprised a small percentage (7%) of the rainbow-brook trout sample again in 1972 (Table 3).

Prior to 1971, rainbow-steelhead and brook trout comprised most of the fish we collected with electrofishing gear during August. Chinook salmon comprised less than 5% of all fish collected. In 1971 and 1972 most of the chinook released in the Creek remained in the stream until September, and chinook fingerlings were the most numerous species in our late summer samples. Of the 13,224 fish we collected in August, 1972, age 0 chinook comprised 57.3% (compared to 78% in 1971), age 0 rainbow-steelhead 37.7% (compared to 7% in 1971), age 1+ rainbow-steelhead 4.2%, age 0 brook trout 0.5%, age 1+ brook trout 0.3%, and whitefish 0.1%. Young-of-the-year rainbow-steelhead trout were much more abundant in 1972, probably a result of the large number of fry released earlier in the summer.

Number of Downstream Migrants

Most juvenile rainbow-steelhead trout migrated from Big Springs Creek during the spring and fall months (Table 4).

The age-class composition of the migrants captured in the traps during 1972 was similar to that of previous years (Table 5). Most of the migrants had spent one summer in the stream (fall migrants were age 0 and spring migrants age I).

During the fall of 1972, 15,380 rainbow-steelhead of the 1972 year-class left the stream, the third largest number since counting began in 1962 (Table 6). In 1971, only 1974 rainbow steelhead of the 1971 year

Table 3. The number of age-class I and older rainbow-steelhead trout and brook trout collected from sample sections of Big Springs Creek during mid-summer.

Year	Number of fish in sample		Percentage of fish in sample	
	Rainbow-steelhead	Brook trout	Rainbow-steelhead	Brook trout
1962	395	31	92.7	7.3
1963	770	60	92.8	7.2
1964	524	53	90.7	9.3
1965	788	45	94.6	5.4
1966	446	42	91.4	8.6
1967	325	52	86.2	13.8
1968	1266	123	91.1	8.9
1969	875	26	97.1	2.9
1970	709	32	95.7	4.3
1971	608	41	93.7	6.3
1972	550	39	93.4	6.6

Table 4. The number of nights the Big Springs Creek downstream migrant weir was operated, number of rainbow-steelhead trout caught, mean catch per night and estimated number of trout which migrated from Big Springs Creek during each month of 1972.

Month	Number of days weir operated	Rainbow-steelhead caught	Catch per day	Estimated number of migrants
January	0		1/	640
February	0		1/	599
March	29	599	20.7	640
April	28	778	27.8	834
May	30	620	20.7	641
June	23	263	11.4	343
July	26	77	3.0	92
August	30	1376	45.9	1422
September	30	3116	103.9	3116
October	29	3212	110.8	3434
November	25	4079	163.2	4895
December	3	301	100.3	3110

1/ Assumed same as March, 1972. Weir not operated due to cold weather.

Table 5. The estimated number, age-class, and year-class of rainbow-steelhead trout which left Big Springs Creek during 1972.

Month	Estimated number	Age-class (percentage)			Number of each year-class		
		0	I	II+	1972	1971	1970
January	640	-	95	5	0	608	32
February	599	-	95	5	0	569	30
March	640	-	95	5	0	608	32
April	834	-	85	15	0	709	125
May	641	-	69	31	0	442	199
June	343	-	93	7	0	318	24
July	92	33	40	27	30	37	25
August	1422	94	6	0	1336	85	0
September	3116	88	12	0	2742	374	0
October	3434	96	4	0	3297	138	0
November	4895	100	0	0	4895	0	0
December	3110	100	0	0	3110	0	0

Table 6. The estimated number of rainbow-steelhead trout of each year-class which left Big Springs Creek during various time periods.

Time period	Year classes												
	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
After first summer													
August-December	--	--	2311	6548	12774	6354	6366	21926	21010	10881	4204	1974	15380
January-July	--	2682 1/	4092	5873	11404	5854	3938	3669	11775	9360	4383	3291	
Total	--	--	6403	12421	24178	12208	10304	25595	32785	20241	8587	5265	
After second summer													
August-December	--	219	311	648	1685	1097	196	682	1008	1072	888	597	
January-July	328 1/	446	533	433	701	373	640	973	1329	854	467		
Total	--	665	844	1081	2386	1470	836	1655	2337	1926	1355		

1/ Partial total, estimates available for April-July period only.

class left the stream in the fall. I reported three factors which might have contributed to the small number of age 0 migrants in the fall of 1971: (1) we released only 136,800 steelhead fry, the second smallest number ever released, (2) we released the fry August 2, the latest date of release since 1962, and (3) a large number of juvenile chinook salmon were present in the Creek to compete with and prey upon the released fry. The number of migrants in the fall of 1971 was smaller than I expected, but I did not know the relative importance of each factor in causing the reduction. The large number of migrants in 1972 is evidence that interaction with chinook salmon juveniles was a minor factor in causing the small number of migrants in 1971.

Relatively few chinook salmon reared in Big Springs Creek each year from 1962 to 1969. Adult chinook salmon were blocked (except for occasional breakdowns) from entering Big Springs Creek by the weir at the mouth of the stream. A few adult salmon were found upstream from the weir occasionally, and small numbers of juvenile salmon entered the creek when the weir was not operating.

The best available index of the number of chinook juveniles which reared in Big Springs Creek is the estimated number of fall-month migrants (Table 7). Migrants of the 1961 year-class were offspring of the last group of fish allowed to spawn in the creek (14 redds were counted). Migrants of the 1962-1966 year-classes were fish which entered the stream as juveniles, probably while the weir was not operating or as offspring of the few adult salmon that escaped past the weir. Fry of the 1967 and 1968 year-classes were released in the creek during December of those years to see if we could

Table 7. Estimated number of age 0 chinook salmon juveniles migrating from Big Springs Creek during the period 1962-1972. Figures in parentheses subjective estimates not based on trapping.

Month	Year class										
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Summer migrants (age 0)											
May	29	97	0	12	0	0	26	0	7248	0	0
June	40	20	0	6	0	1	33	0	2343	4054	3590
July	1	0	0	4	0	0	6	0	3959	2875	1270
August	1	0	0	3	2	0	14	4	44	357	2015
Sub-total	71	117	0	25	2	1	79	4	13594	7286	6875
Fall migrants (age 0, pre-smolts)											
September	33	0	20	45	70	3	336	21	120	5907	11438
October	342	183	211	65	(100)	279	576	157	498	25262	29881
November	80	246	132	102	60	399	258	(100)	198	13476	12798
December	(40)	34	53	(50)	152	177	186	126	132	7099	2470
Sub-total	495	463	416	262	382	858	1356	404	948	51744	56587
Spring migrants (age I, smolts)											
January	(10)	(20)	6	19	30	0	(20)	72	(33)	(704)	
February	(10)	(20)	20	20	36	(10)	(20)	14	(33)	(658)	
March	7	(20)	6	12	16	4	21	19	33	704	
April	12	39	2	10	14	19	5	43	83	936	
May	12	9	7	19	4	14	2	17	6	335	
June	10	6	6	8	6	0	0	13	0	24	
Sub-total	61	114	47	88	106	47	68	178	188	3361	
Total migrants	627	694	463	375	490	906	1503	586	14730	62391	

increase smolt yield with winter (normal emergence time) fry releases. Migrants of the 1969, 1970 and 1971 year-classes were from fingerlings released in the stream during late spring.

On May 31 and June 1, 1972, we released 291,600 chinook fingerlings (55-65 mm mean fork length) in the creek.

The chinook reared all summer in the stream and started leaving in large numbers in September, with peak numbers leaving in October (Table 7). Nearly 57,000 chinook left the stream during the fall (September-December) so that minimum survival of fingerling released to migrating pre-smolt exceeded 20%. Additional chinook from the 1972 release will leave the stream in the first half of 1973. Some chinook from the 1971 release remained in the Creek through the 1971-72 winter and then migrated in the spring of 1972, but the number, although more than any other spring, was small compared to the fall migration.

Rainbow-steelhead Downstream Migrants - Upper Lemhi River

In 1972 most juvenile rainbow-steelhead trout migrated from the upper Lemhi River past the Lemhi weir site during the months of April, May, September and October. The peak of movement in the spring was in May, the same as in previous years.

Most of the juvenile rainbow-steelhead caught in the louver trap had reared two or more summers in the stream (Table 8). As in previous years, subyearlings which left Big Springs Creek and continued migrating down the Lemhi River comprised a small proportion of the fish passing the weir site.

Table 8. The number of days Lemhi louver trap was operated, catch of juvenile rainbow-steelhead trout, and percentage age-class composition of catch in 1972.

Month	Days of operation	Fish caught	Percentage in each age group			
			0	I	II	III
January	8	1	--	0	100	0
February	21	5	--	50	50	0
March	30	24	--	0	100	0
April	30	75	--	0	95	5
May	31	249	--	0	98	2
June	30	51	--	0	100	0
July	31	7	--	100	0	0
August	31	19	66	34	0	0
September	30	142	18	80	2	0
October	28	72	25	73	2	0
November	30	55	50	50	0	0
December	3	8	50	50	0	0

A mark-recapture program was conducted at the Lemhi weir again in the fall of 1972 to determine the percentage of total rainbow-steelhead migrants passing the weir site that were captured in the lower trap. The program was similar to that in 1965-66 (Bjornn, 1966). During the fall, 107 marked fish were released and 4.0% were recovered.

The estimated number of smolt-sized rainbow-steelhead trout passing the Lemhi River weir site (Table 9) has ranged from a low of 6,400 (1970 year class) to a high of 20,900 (1968 year class). Although the count
of 3-year-olds of the 1970 year-class was not complete by the end of 1972, the number of 1970 year-class migrants will not exceed 7,000 fish.

All rainbow-steelhead trout captured at the Lemhi weir were examined for fin-clips to determine the proportion of rainbow-steelhead migrants which originated from Big Springs Creek. During the spring of 1972, more than 90% of the fish caught were age II fish of the 1970 year-class. Of the 406 fish caught, 99 (24.4%.) had been fin-clipped and released at the Big Springs Creek weir. More than 90% of the fall, 1971 migrants were also of the 1970 year-class and 22.5% of the fish caught were fin-clipped. Altogether 49.9% of the 1970 year-class of rainbow-steelhead were marked as they migrated from Big Springs Creek and I estimated that nearly 50% of the 6,400 yearling and older migrants of the 1970 year-class passing the weir site were from Big Springs Creek (2,976 fish, Table 9).

Subyearlings of the 1970 year-class (as well as the other year classes) which left Big Springs Creek and reared an additional year in the upper Lemhi River were a significant proportion of the smolts which originated in Big

Table 9. The estimated number of rainbow-steelhead trout of each year class which migrated from Big Springs Creek, past the Lemhi River weir site and number of smolts passing Lemhi weir site of Big Springs Creek origin.

Migration past	Year class										
	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Big Springs Creek											
Subyearling [2]	6403	12421	24178	12208	10304	25595	32785	20241	8587	5265	15380 [1]
Yearlings	844	1081	2386	1470	836	1655	2337	1926	1355	597 [1]	
Lemhi River											
Subyearlings	-- [3]	--	2517	672	2505	1896	966	2930	533	799	3397 [1]
Yearlings	--	7015	11253	11059	8894	12231	20813	10940	6332	5725 [1]	
3-Year-olds	488	457	469	244	168	884	105	216	100 [1]		
Lemhi River											
Big Springs Creek "smolts"		2999	4842	2850	3081	3299	8337	5670	2976 [1]		

1/ Count not complete.

2/ Subyearlings have completed one growing season.
Yearlings have completed two growing seasons.
3-Year olds have completed three growing seasons.

3/ No estimate available.

Springs Creek. In each case 507 or more of the Big Springs Creek smolts leaving the upper Lemhi River were fish which had left Big Springs Creek as subyearlings. Nearly three-fourths of the Big Springs Creek smolts of the 1968 year-class, and two-thirds of the 1969 year-class were fish which had left Big Springs Creek after their first summer and had reared an additional year in the Lemhi River. Approximately 20% of the subyearlings from the creek must have survived during their second year of life in the Lemhi River.

Survival of fry released into Big Springs Creek to the smolt stage ranged from 1.5 to 3.87 for the 1963-70 year-classes (Table 10).

The yield of subyearling rainbow-steelhead in Big Springs Creek (Table 11) 2 ranged from 7.8 to 40.0 fish per 100 yd while the yield of yearlings ranged from 0.8 to 2.9 for the 1961-71 year-classes. The yield of chinook salmon 2 for the 1971 and 1972 releases of fingerlings was 76.1 fish per 100 yd for the 1971 release and 69.0 for the 1972 release (count not complete).

In 1971, the first growing season with large numbers of chinook in the 2 stream,the yield of subyearling rainbow-steelhead was only 6.4 per 100 yd (Table 11), but part of the reason for the smaller yield was the small number of fry released and perhaps the late date of release. In 1972, we had a large population of age 0 chinook salmon in the stream, as in 1971, but we released a larger number of steelhead fry (358,000) at an earlier date (June 21). The yield of chinook through the fall of 1972 was large 2 (69.0 fish per 100 yd), as in 1971, and the yield of rainbow-steelhead was nearly triple that of 1971. Large numbers of both species can rear in the stream sympatrically.

Table 10. The estimated yield of steelhead trout smolts in the upper Lemhi River drainage from steelhead trout fry released into Big Springs Creek.

	1963 year-class		1964 year-class		1965 year-class		1966 year-class	
	Number of fish	Percentage of fry released	Number of fish	Percentage of fry released	Number of fish	Percentage of fry released	Number of fish	Percentage of fry released
Fry released	193,319	100.0	289,409	100.0	151,461	100.0	136,865	100.0
Big Springs Creek								
Subyearlings	12,421	6.4	24,178	8.1	12,208	8.1	10,304	7.5
Yearlings	1,081	0.6	2,386	0.8	1,470	1.0	836	0.6
Lemhi weir site								
Yearlings+	2,999	1.6	4,842	1.6	2,850	1.8	3,049	2.2

	1967 year-class		1968 year-class		1969 year-class		1970 year-class	
	Number of fish	Percentage of fry released	Number of fish	Percentage of fry released	Number of fish	Percentage of fry released	Number of fish	Percentage of fry released
Fry released	213,599	100.0	219,000	100.0	322,400	100.0	206,000	100.0
Big Springs Creek								
Subyearlings	25,595	12.0	32,785	15.0	20,241	6.3	8,587	4.2
Yearlings	1,655	0.8	2,337	1.1	1,926	0.6	1,355	0.7
Lemhi weir site								
Yearlings+	3,299	1.5	8,280	3.8	5,670	1.8	2,976 1/	1.4

1/ Preliminary.

Table 11. The yield of rainbow-steelhead trout migrants per 100 square yards in Big Springs Creek.

Year-class	Subyearlings		Yearlings	
	Number of migrants	Number per 100 yd^2	Number of migrants	Number per 100 yd^2
1961			655	0.8
1962	6,403	7.8	844	1.0
1963	12,421	15.1	1,081	1.3
1964	24,178	29.5	2,386	2.9
1965	12,208	14.9	1,470	1.8
1966	10,304	12.6	836	1.0
1967	25,595	31.2	1,655	2.0
1968	32,785	40.0	2,337	2.9
1969	20,241	24.7	1,926	2.3
1970	8,587	10.5	1,355	1.7
1971	5,265	6.4		
1972	15,380 1/	18.8		

1/ Count not complete.

LITERATURE CITED

Bjornn, T. C. 1966. Steelhead trout production studies, Lemhi Big Springs Creek. Annual Completion Report, Project F-49-R-4, Idaho Fish and Game Department, 183pp.

JOB COMPLETION REPORT RESEARCH PROJECT SEGMENT

State of Idaho | Name SALMON AND STEELHEAD INVESTIGATIONS

Project No. F-49-R-11 | Title Salmon and Steelhead Yield, Escapement, and Harvest Studies, Lemhi River

Job No. II-b

Period Covered: March 1, 1972 to February 28, 1973

ABSTRACT

The 1185 adult chinook salmon counted at the Lemhi weir in 1972 was an average run. Age 4_2 fish which had spent 2 years in the ocean made up 44% of the run and age 5_2 fish, 53%. No eggs were taken from Lemhi River chinook in 1971. An estimated 683 females were available for spawning in 1971, with an estimated deposition of 3,076,000 eggs.

An estimated 245,000 chinook juveniles of the 1970 year-class migrated from the upper Lemhi River plus an additional 33,000 fish which reared during the summer of 1971 in Big Springs Creek and left that stream during the same fall. In 1972, 179,000 chinook migrated from the upper Lemhi River, but 31% (56,000) of those fish were from Big Springs Creek.

Survival from smolt to returning adult for the four year-classes of chinook salmon that have returned to the weir ranged from 0.25 to 1.22%.

Eighty-eight adult steelhead were collected at the weir in 1972. Most of the fish ranged from 27-32 inches in length and came from the mid-Snake River fry released into Big Springs Creek in 1967.

Author: Ted C. Bjornn
Idaho Cooperative Fishery Unit
Moscow, Idaho

RECOMMENDATIONS:

The upstream and downstream migrant facilities should be operated as in the past to assess the number of salmon and steelhead juveniles and adults produced in the Lemhi River drainage. If a large natural spawning escapement of salmon does not occur in 1973, then additional fry from other sources should be added to the Lemhi River to provide the number of fry that would result from a large number of spawning fish. A large escapement is needed to verify the spawner-smolt relationship for the Lemhi River.

Large numbers of steelhead fry should be released in the Lemhi River to determine if a natural run can be established by such releases.

OBJECTIVES:

1. To estimate the yield of chinook salmon and steelhead trout smolts from the Lemhi River upstream from the mouth of Hayden Creek.

2. To estimate the spawning escapement of chinook salmon and steel-head trout in the upper Lemhi River.

3. To determine the relationship of counts obtained in annual spawning ground surveys to the estimated spawning escapement of chinook salmon; and, to compare these two factors to the resultant estimated yield of chinook salmon smolts in the upper Lemhi River.

TECHNIQUES USED:

The upstream migrant rack was installed March 4 and removed October 9 in 1972.

The length (age) of adult salmon was determined as they swam across a marked plate at the exit of the adult trap. Fish were not handled except

for spawn taking and to remove tags.

The louver trap was operated throughout the year to capture a sample of downstream migrants. A mark and recapture program was conducted in the fall of 1972 to estimate the proportion of migrating fish collected in the louver trap. The fish were marked with fin clips and then released upstream 1-2 miles from the weir.

FINDINGS:

Enumeration of Adult Chinook Salmon

The first adult chinook entered the upstream migrant trap at the Lemhi weir May 24 and the last on September 10 during 1972. As in past years, the salmon entered the upper Lemhi River in two major groups, June —early July and August. The 1972 run of 1185 fish was one of the medium sized runs (Table 1). The portion of the run passing the weir in August was 31%. In past years, eggs for artificial propagation have been collected from fish entering the weir trap in August and there was some concern that we might have depleted the August portion of the run. The adults which returned in 1972 were offspring of the 1967 and 1968 runs. In those two years, nearly all fish entering the trap during August were held for spawn taking and their eggs sent to other drainages.

The percentage of the run passing upstream during August in 1972 was not below average (Table 2), in spite of the fact that few fish of the parent runs which entered the trap during August were allowed to spawn naturally . I conclude on the basis of data available that the June-July and August groups of fish are not distinct races.

Table 1. Daily counts of adult chinook salmon at the Lemhi River weir during 1972.

Date	May	June	July	August	September
1			39	10	4
2			10	8	5
3			34	10	7
4		1	11	8	1
5			18	5	
6			28	10	2
7		2	46	8	2
8		1	73	7	
9			34	5	2
10			26	17	5
11		3	21	13	
12			23	7	
13		1	46	7	
14			17	16	
15		1	9	14	
16			5	17	
17			15	23	
18			10	14	
19		1	10	17	
20		3	6	29	
21		2	0	18	
22		8	2	23	
23		9	7	20	
24	1	20	3	5	
25		8	7	12	
26		31	4	11	
27		36	9	17	
28		41	2	7	
29	1	47	6	7	
30		35	5	3	
31	1		9	1	
Totals	3	250	535	369	28

Table 2. Count of chinook salmon at the Lemhi weir by month and percentage of total run passing weir in August

Year	Month					Total	Percentage in August
	May	June	July	Aug.	Sept.		
1964	-	99 1/	470	460	46	1075	43
1965	0	21	440	287	17	765	38
1966	0	1055	36	357	25	1473	24
1967	23	745	443	559	64	1834	30
1968	31	1390	174	327	21	1943	17
1969	0	235	295	202	23	755	27
1970	51	443	518	176	29	1217	14
1971	0	2	567	234	29	832	28
1972	3	250	535	369	28	1185	31

1/ Weir installed June 24.

The 1972 run was composed primarily of fish which had spent 2 (age 4_2) years in the ocean (Table 3). As usual, "jacks" (age 3_2) comprised a small percentage (2.8%) of the run.

Table 3. Length-age group of chinook salmon counted at the Lemhi weir in 1972.

Month	Number of fish in length-age groups		
	3_2 (<24")	4_2 (24-31")	5_2 (32"+)
May	0	0	3
June	1	111	138
July	21	240	274
August	10	160	199
September	1	15	12
Totals	33	526	626
Percentages	2.8	44.4	52.8

Chinook Salmon Spawn-taking Operation

No eggs were collected from Lemhi River chinook salmon in 1972.

Estimated Spawning Escapement

We released all 1185 fish to spawn above the weir in 1972. I have estimated that 3% of the fish released at the weir were females based on the percentage of females observed in spawning ground surveys (63%).

The sport fishery operated in 1972, and the estimated harvest (salmon punch cards) was 221 fish from the entire Lemhi River. I have arbitrarily assumed 100 fish were harvested upstream from the weir.

The estimated number of spawners upstream from the weir in 1972 was 1085 fish (weir count minus harvest). The estimated egg deposition was 3,076,000 eggs (number of females (683) x number of eggs per female, 4,500). The estimated egg deposition was a maximum value as mortality of spawners after release from the weir was ignored but may have been substantial in 1972 due to delayed mortality from gas bubble disease.

Redds counted

There were 473 redds counted in the Lemhi River upstream from the weir in 1972.

Enumeration of Adult Steelhead Trout

Eighty-eight adult steelhead trout were captured at the Lemhi weir during the spring of 1972. The first fish was taken March 21 and the last May 25 (Table 4).

Table 4. The daily count of adult steelhead trout at the Lemhi River weir during 1972.

Date	March	April	May
1		4	2
2		1	4
3		1	7
4			8
5		1	3
6			
7			1
8			1
9		2	5
10		1	2
11			1
12		2	5
13			
14			4
15			3
16			
17		1	1
18		2	
19			
20		1	
21	1	2	
22		2	
23		1	1
24	1	3	
25		2	1
26			
27		2	
28		7	
29		1	
30	1		
31			
Total	3	36	49

Steelhead which returned to the Lemhi River in the spring of 1972 originated from fry released into Big Springs Creek in 1966, 1967 and 1968.

Smolts of the 1966 and 1967 year-classes migrated to the ocean in 1968 and 1969. These fish were of Snake River (Oxbow Dam) origin and would normally return in the 2nd and 3rd year after leaving as smolts but at a smaller size than the fish of Clearwater River origin.

Smolts of the 1968 year-class migrated to the ocean in 1970. These fish were from the Clearwater drainage and would normally return in their third year (1973) after leaving as smolts, but some could return in their second year (1972) or fourth year (1974).

In 1972, 21 marked, adult steelhead were captured at the Lemhi River weir (Table 5). Sixteen of the marked fish had adipose fin clips they received as they left Big Springs Creek as juveniles, and 5 fish had deformed dorsal fins, an indication they might have originated from the smolts released into Hayden Creek. All of the fish with deformed dorsals were 23-25 inches in length as were 5 of the fish with adipose clips. I therefore assumed that half of the marked fish in that size range were from Big Springs Creek and half from Hayden Creek. The remainder of the fish were from Big Springs Creek.

Of the 88 fish counted at the weir in 1972, I estimate 14% (12 fish) were strays from Hayden Creek, and 86% (76 fish) were from Big Springs Creek. Based on the length-frequency distribution, I further divided the 76 fish from Big Springs Creek with 20 fish (26%) coming from the 1968 year-class, 54 fish (71%) crom the 1967 year-class, and 2 fish

Table 5. Length-frequency of adult steelhead trout captured and measured at the Lemhi River weir in 1972.

Total Length	Number of fish			
	Unmarked	Adipose clip	Deformed dorsal	Total
20				
21	1			1
22				
23	1	1	2	4
24	5	2	2	9
25	3	2	1	6
26	4	2		6
27	2	2		4
28	7	4		11
29	9	2		11
30	8	1		9
31	6			6
32	2			2
33	1			1
34	1			1
35	1			1
36	—	—	—	—
Totals	51	16	5	72

from the 1966 year-class.

Smolt-to-adult survival for four year-classes of steelhead released into Big Springs Creek has ranged from 0.5 to 2.2%.

Enumeration of Juvenile Salmon

Both juvenile salmon and steelhead were enumerated at the louver trap but only the salmon will be covered in this report. The migration of juvenile steelhead in the Lemhi River is covered in Job No. 2a report of this project.

As in past years, young-of-the-year and/or yearling chinook salmon migrated down the Lemhi River past the weir site every month of the year (Table 6). The largest numbers migrated during the fall and spring months.

A mark and recapture program was conducted during the fall of 1972 to determine the percentage of fish migrating down the river that were caught in the louver trap. During the fall, 3654 chinook juveniles were marked and released and 130 (3.56%) were subsequently recaptured.

Juveniles (smolts) of the 1970 year-class migrated during the spring of 1972 and pre-smolts of the 1971 year-class migrated during the fall of 1972 (Table 7). The 278,000 fall (pre-smolt) and spring (smolt) migrants of the 1970 year-class was one of the largest out-migrations since counting began (Table 8). However, an estimated 33,000 of the migrants were from Big Springs Creek so that only 245,000 of the migrants were from natural spawning and rearing in the upper Lemhi River.

The 179,000 pre-smolt migrants of the 1971 year-class was one of the larger counts of fall migrants (Table 7), but an estimated 41% (56,000) of those migrants were chinook from Big Springs Creek. Nearly all of the

Table 6. The number of days the Lemhi River louver trap was operated, chinook young-of-the-year and yearlings caught, and the estimated number of juveniles migrating downstream past the trap site in 1972.

Month	Days of operation	Chinook caught		Estimated total for month		Estimated number migrating	
		YOY	Yrlgs.	YOY	Yrlgs.	YOY	Yrlgs.
January	8	0	339	0	1314	0	36,923
February	21	55	495	76	683	21,713	19,192
March	30	152	636	157	655	44,855	18,405
April	30	120	359	120	359	34,284	10,088
May	31	8	564	8	564	2,286	15,848
June	30	58	53	58	53	1,630	1,489
July	31	18	8	18	8	505	225
August	31	43	43	43	43	1,208	1,208
September	30	456	22	456	22	12,814	618
October	28	1,772	0	1,962	0	55,132	0
November	30	2,241	0	2,241	0	62,972	0
December	3	260	0	1,727[1/]	0	48,529	0

1/ Based on mean catch per day (55.7) for December, 1972, and February, 1973. Data for first 3 days of December, 1972, insufficient to estimate catch for entire month.

Table 7. The estimated number (in thousands) of juvenile chinook salmon which migrated from the upper Lemhi River during various periods following emergence.

Time period life stage	Year-Class 1963	1964	1965	1966	1967	1968	1969	1970	1971
Recently emerged fry January - May	--	794	389	301	591	759	267	910	103
Fingerlings June-August	33	35	11	6	12	5	11	19	3
Pre-smolts September-December	106	230	107	70	168	217	91	176 1/	184 2/
Smolts January-June	68	171	78	38	69	80	38	102 1/	
Precocious males July-September	11	7	9	8	6	4	3	2	
Totals	218	1237	594	423	846	1065	410	1209	

1/ An estimated 33,000 of these migrants were from Big Springs Creek.

2/ Preliminary estimate of 56,000 fish from Big Springs Creek included in this number.

Table 8. Measures of spawning escapement and yield of juvenile chinook salmon for the upper Lemhi River, 1964-1971.

Year Class	Redd count	Weir count	Estimated escapement All	♂ ♀	Estimated egg deposition (000)	Fry Abundance index (Feb-May catch/day)	Chinook juvenile downstream migrants June-Aug	Sept-Dec	Jan-June	Fall and spring total
1963	364						32,541	106,122	65,080	174,000
1964	1038	1075 1/				23.8	35,132	229,780	171,050	401,000
1965	453	765	765	413	1859	11.7	10,537	106,970	77,754	185,000
1966	738	1473	1262	581	2673	8.8	6,461	70,327	38,384	109,000
1967	786	1844	1392	683	3210	17.1	12,235	168,352	69,414	238,000
1968	572	1943	1370	745	3696	11.4	5,414	216,802	80,275	297,000
1969	328	755	535	321	1446	7.8	10,858	90,708	38,035	129,000
1970	358	1217	974	487	2435	24.4	19,937	176,017	101,945	245,000 2/
1971	392	831	749	487	2191	3.0	3,343	179,447		
1972	473	1185	1085	683	3076					

1/ Not complete, from June 24 only.

2/ Adjusted to exclude fish from Big Springs Creek.

of the chinook migrants which left the creek in the fall months migrated on downstream past the Lemhi River weir site according to my estimates. Without the migrants from Big Springs Creek, the number of chinook migrating from the upper Lemhi River was about 123,000 fish.

With the return of age 5_2 adult salmon in 1972, we have complete adult returns of five year-classes to the Lemhi weir. We estimated 238,000 smolts and pre-smolts of the 1967 year-class migrated from the upper Lemhi River past the Lemhi weir site. Adults from the 1967 year-class returned as age 3_2, 4_2, and 5_2 fish in 1970, 1971 and 1972 respectively. The 1288 returning adults of the 1965 year-class comprised 0.54% of the 238, 000 smolts. Smolt-adult survival rate for the 1963, 1964, 1965 and 1966 year-classes was 1.2, 0.25, 0.58 and 0.81% respectively. Returning adults may have originated from fish other than the "smolts" counted at the weir. For example, there are large numbers of fry which migrate from the upper Lemhi each year and these fish may survive and rear in the lower Lemhi River or Salmon River. In addition a few chinook salmon spawn in the lower Lemhi and fish returning to the weir could be offspring of these fish.

Submitted by:
Ted C. Bjornn
Idaho Cooperative Fishery Unit
University of Idaho
Moscow, Idaho

Approved by:
IDAHO FISH AND GAME DEPARTMENT.

Joseph C. Greenley, Director

James C. Simpson, Chief
Fisheries Division

Jerry Mallet
Fishery Research Supervisor